

## TITLE OF THE INVENTION

### ELECTRONIC EQUIPMENT AND PUSHBUTTON USED THEREIN

## BACKGROUND OF THE INVENTION

### Field of the Invention

The present invention relates to electronic equipment which with a pushbutton mounted on a panel thereof.

### Description of the Related Art

Fig. 1 shows the constitution of a pushbutton used in conventional electronic equipment of this type. In Fig. 1, the electronic equipment on which the pushbutton is mounted includes a pushbutton 103 which has a manipulation surface 103a thereof projected from a button hole 102 formed in a face panel 101, a chassis 104 which has a guide portion 104a which slidably guides an angled cylindrical barrel portion 103b of the pushbutton 103, a board 106 which is fixed to the chassis 104 by mounting screws 105, a rubber contact switch 107 which is mounted on the board 106 and operated when a distal end portion of the barrel portion 103b of the pushbutton 103 pushes the rubber contact switch 107, and an LED (light emitting diode) 108 which is mounted on a circuit of the board 106. The LED 108 is arranged between a pair of fixed contacts 107b of the rubber contact switch 107. When an operator pushes the manipulation surface 103a of the pushbutton 103, movable contacts 107a of the rubber contact switch 107 are pushed by the distal end portion of the barrel portion 103b and hence, the movable contacts 107a are brought into contact with and become conductive with the fixed contacts 107b on the board 106

whereby given functional portions are operated and, at the same time, the LED 108 is lit or turned on and letters and symbols formed on an illumination portion 103b on the manipulation surface 103a of the pushbutton 103 are illuminated.

A task to be solved with respect to the electronic equipment provided with such a pushbutton is the alignment of an axis of the guide portion 104a of the chassis 104 and an axis of the button hole 102 formed in the face panel 101. When these axes are not aligned with each other due to a dimensional error or a mounting error, the manipulation surface 103a of the pushbutton 103 does not accurately project from the button hole 102 formed in the face panel 101. That is, there may be a case that the manipulation surface 103a is caught by a periphery of the button hole 102 leading to a defective operation. Further, in a worst case, it is impossible to make the pushbutton 103 project from the button hole 102. In view of the above drawbacks, conventionally, there has been known the structure in which an intermediate member is arranged between the pushbutton 103 and the chassis 104 and play is formed between the pushbutton 103 and the intermediate member, whereby irregularities of the dimensional error or the mounting error can be absorbed by the play (for example, Japanese Unexamined Utility Model Publication No. Sho 59-69439 (pages 3 to 6, Fig. 2)).

However, in the abovementioned conventional structure which absorbs the irregularities of the dimensional error or the mounting error, the pushbutton has play and hence, there have been drawbacks that the pushbutton tilts in a pushbutton hole, the pushbutton generates weird noise, and the

manipulation feeling is poor. Particularly, when the face panel is made of wood, it is difficult to obtain the dimensional accuracy with respect to the positional accuracy of the button hole compatible to the corresponding dimensional accuracy obtainable in forming the button hole in a metal sheet or resin molded product and hence, the abovementioned drawback becomes more noticeable.

The present invention has been made to solve the abovementioned drawbacks and it is an object of the present invention to provide electronic equipment and a pushbutton to be used in such electronic equipment which can make the pushbutton accurately project from a button hole and can prevent play even when the positional accuracy of the button hole formed in a face panel is poor.

#### SUMMARY OF THE INVENTION

To achieve the abovementioned object, electronic equipment according to the present invention includes an outer button which has a manipulation surface which can be manipulated through a button hole formed in a panel, an inner button which is mounted inside the outer button such that the inner button is movable relative to the outer button, a chassis which has a guide portion for slidably guiding the inner button, a switch which is mounted on a board fixed to the chassis and is operated by the inner button, and positioning means which position the outer button with respect to the panel. Due to such a constitution, since the outer button is movable with respect to the inner button which is fixed to the chassis, even when

the positional accuracy of the button hole formed in the panel is poor, it is possible to make the manipulation surface of the outer button accurately project through the button hole and, at the same time, it is possible to prevent play of the outer button due to the provision of the positioning means.

Further, in the electronic equipment of the present invention, the positioning means include an engaging portion which is integrally formed with the outer button and a portion to be engaged which is formed in the panel and is engageable with the engaging portion. Due to such a constitution, it is possible to easily implement the positioning means.

Further, in the electronic equipment of the present invention, the engaging portion is constituted of a pair of engaging projections which are formed on both sides of the outer button and the portion to be engaged is constituted of a pair of engaging holes which are engageable with the pair of engaging projections. Due to such a constitution, positioning of the outer button with respect to the panel can be performed without play.

Further, in the electronic equipment of the present invention, the manipulation surface of the outer button is inclined in a longitudinal direction with respect to the chassis, and, of the pair of engaging projections, the engaging projection which is away from the chassis with a shorter distance projects in a sideward direction of the outer button and the engaging projection which is away from the chassis with a longer distance projects upward from a side of the outer button. Due to such a constitution, even when the outer button is

inclined in the longitudinal direction with respect to the chassis, it is possible to ensure positioning of the outer button with respect to the panel and hence, it is possible to cope with various designs of the outer buttons.

Further, in the electronic equipment of the present invention, an illumination portion is formed on the manipulation surface of the outer button, the inner button is made of a light guiding material, and a light emitting diode is arranged to face the inner button in an opposed manner. Due to such a constitution, even when the illumination portion of the outer button is arranged at a position remote from the light emitting diode, it is possible to effectively illuminate the illumination portion of the outer button through the inner button made of the light guiding material.

Further, a pushbutton according to the present invention includes an outer button which has a manipulation surface, an inner button which is mounted inside the outer button such that the inner button is movable relative to the outer button, an engaging portion which is formed on an outer side of the outer button for positioning the outer button with respect to the panel, and an engaging portion which is formed on a barrel portion of the inner button for mounting the inner button on a chassis. Due to such a constitution, in inserting the barrel portion of the inner button of the pushbutton into a guide portion of the chassis and projecting the manipulation surface of the outer button through a button hole formed in the panel, even when the positional accuracy of the button hole formed in the panel is poor, it is possible to make the manipulation

surface of the outer button accurately project through the button hole formed in the panel and, at the same time, it is possible to prevent play of the outer button with respect to the panel.

As has been explained heretofore, electronic equipment according to the present invention includes an outer button which has a manipulation surface which can be manipulated through a button hole formed in a panel, an inner button which is mounted inside the outer button such that the inner button is movable relative to the outer button, a chassis which has a guide portion for slidably guiding the inner button, a switch which is mounted on a board fixed to the chassis and is operated by the inner button, and positioning means which position the outer button with respect to the panel. Accordingly, even when the positional accuracy of the button hole formed in the panel is poor, it is possible to make the manipulation surface of the outer button accurately project through the button hole and, at the same time, it is possible to prevent play of the outer button due to the provision of the positioning means.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic cross-sectional view showing the constitution of a pushbutton portion of electronic equipment as a conventional example;

Fig. 2 is a schematic cross-sectional view showing the constitution of a pushbutton portion of electronic equipment in one embodiment of the present invention; and

Fig. 3 is a schematic exploded perspective view showing

the constitution of a pushbutton portion of electronic equipment in one embodiment of the present invention.

#### DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment of the present invention is explained in detail in conjunction with drawings. Fig. 2 is a schematic cross-sectional view showing the constitution of a pushbutton portion of electronic equipment according to one embodiment of the present invention and Fig. 3 is an exploded perspective view thereof. In Fig. 2, this electronic equipment is applied to a center console in a vehicle cabin and includes an outer button 3 which has a manipulation surface 3a projecting through a button hole 2 formed in a face panel 1 of the console, an inner button 4 which is mounted inside the outer button 3 such that the inner button 4 is movable relative to the outer button 3, a chassis 5 which includes a guide portion 5a which slidably guides an angled cylindrical barrel portion 4a of the inner button 4, a board 7 which is fixed to the chassis 5 by mounting screws 6, a rubber contact switch 8 which is arranged on the board 7 and operated when the rubber contact switch 8 is pushed by a distal end portion of the barrel portion 4a of the inner button 4, and an LED (light emitting diode) 9 which is mounted on a circuit of the board 7. The LED 9 is arranged between a pair of fixed contacts 8b of the rubber contact switch 8 such that the LED 9 faces a center portion of the barrel portion 4a of the inner button 4 in an opposed manner.

The outer button 3 is made of a semitransparent resin material and is formed into a rectangular box shape by molding,

wherein the manipulation surface 3a is inclined in the longitudinal direction such that an end portion side of the outer button 3 becomes low with respect to the chassis 5. Further, with respect to both side surfaces of the outer button 3 in the x direction which is the longitudinal direction, on one side surface of the outer button 3 where a distance from the chassis 5 is short, a block-like engaging projection 3b is formed such that the projection 3b projects sideward, while on another side surface of the outer button 3 where a distance from the chassis 5 is long, a pin-like engaging projection 3c is formed in a state that the projection 3c projects upward from the side of the outer button 3. The engaging projection 3b is positioned at an approximately center portion of one side surface of the outer button 3, while the engaging projection 3c projects from a corner of another side surface of the outer button 3. Then, in a back surface of the face panel 1, at positions which face these engaging projections 3b, 3c, engaging holes 1a, 1b are respectively formed. These engaging projections 3b, 3c and the engaging holes 1a, 1b constitute the positioning means of the outer button 3. Further, on an inner side of the manipulation surface 3a of the outer button 3, a pair of stopper projections 3d, 3e which position the inner button 4 with respect to the outer button 3 in the z direction which is the height direction are formed. On a front side of the manipulation surface 3a, letters or symbols are formed in an illumination portion 3f. These letters or symbols may be formed by exposing the inner semitransparent resin material by shaving off a surface coating of the manipulation surface 3a



by laser cutting.

The inner button 4 is made of a resin material having a light guiding property and is formed by molding. A top portion 4b which supports a flattened box-like barrel portion 4a extends in the x direction beyond a guide portion 5a of the chassis 5 and arm portions 4c, 4d are downwardly formed from both end portions of the top portion 4b. Engaging pawls 4e, 4f are formed on distal end portions of the arm portions 4c, 4d such that the engaging pawls 4e, 4f extend laterally and outwardly. On the other hand, in lower end portions of both side surfaces of the outer button 3, engaging holes 3g, 3h are formed at positions which face these engaging pawls 4e, 4f in an opposed manner. The engaging holes 3g, 3h are formed of elongated holes which are elongated in the y direction which is a direction perpendicular to a plane of this sheet in Fig. 2 and hence, the outer button 3 is movable in the x, y directions relative to the inner button 4. Further, at center portions of lower portions of both side surfaces of the barrel portion 4a of the inner button 4 in the y direction, rectangular engaging holes 4g, 4h are formed and these engaging holes 4g, 4h are engageable with engaging pawls 5b, 5c formed on the chassis 5. Here, the positions of the engaging projections 3b, 3c formed on the outer button 3 are not limited to the abovementioned positions and can be arbitrarily set in view of the relationship between the outer button 3 and the face panel 1 and the like.

Next, the assembling and the manner of operation of the electronic equipment of this embodiment are explained. First of all, the chassis 5 to which the board 7 is fixed is mounted

in a mounting hole formed in the center console of the vehicle. Next, the inner button 4 is pushed into the inside of the outer button 3. In such a pushing operation, the arm portions 4c, 4d at both sides of the inner button 4 are deflected inwardly and the engaging pawls 4e, 4f formed on the distal end portions of the arm portions 4c, 4d are engaged with the engaging holes 3g, 3h formed in the outer button 3. Since the play is present in the x, y directions in such an engagement, the outer button 3 and the inner button 4 are movable relative to each other. Next, when the barrel portion 4a of the inner button 4 to which the outer button 3 is assembled is inserted by pushing into the inside of the guide portion 5a of the chassis 5, the engaging holes 4g, 4h formed in the inner button 4 are engaged with the engaging pawls 5b, 5c formed on the chassis 5 and hence, the assembled body of the outer button 3 and the inner button 4 is mounted on the chassis 5. Then, the face panel 1 is mounted over the assembled body by positioning the face panel 1 such that the manipulation surface 3a of the outer button 3 projects through the button hole 2 formed in the face panel 1. Here, even when an axis of the guide portion 5a of the chassis 5 and an axis of the button hole 2 formed in the face panel 1 are displaced from each other, since the outer button 3 is configured to be movable relative to the inner button 4, the outer button 3 moves while following or tracing the button hole 2 formed in the face panel 1. Further, the engaging projections 3b, 3c of the outer button 3 are respectively fitted into the engaging holes 1a, 1b formed in the face panel 1 so that the play of the outer button 3 is prevented. Then, after completion

of assembling, when an accessory switch of the vehicle is turned on and the manipulation surface 3a of the outer button 3 is pushed, the rubber contact switch 8 is pushed by the distal end portion of the barrel portion 4b of the inner button 4 and hence, the movable contacts 8a are brought into contact with the fixed contacts 8b on the board 7 and become conductive with the fixed contacts 8b. Accordingly, given functional parts are operated and, at the same time, the LED 9 is turned on and light which passes through the inner button 4 having the light guiding property is emitted from the top portion 4b so as to illuminate the letters and the like of the illumination portion 3f formed on the manipulation surface 3a of the outer button 3.

In this manner, according to this embodiment, the outer button 3 and the inner button 4 are mounted in a state that these buttons 3, 4 are movable relative to each other and, at the same time, the engaging projections 3b, 3c of the outer button 3 are respectively positioned at the engaging holes 1a, 1b of the face panel 1. Accordingly, even when the axis of the button hole 2 of the face panel 1 and the axis of the guide portion 5a of the chassis 5 are displaced from each other, it is possible to make the manipulation surface 3a of the outer button 3 accurately project through the button hole 2 and, at the same time, it is possible to prevent the play of the outer button 3. Particularly, when the wooden panel is used to impart high-grade feeling to the face panel 1, the positioning accuracy in forming the button hole 2 inevitably becomes low (since the blanking which can be applied to a metal panel cannot be applied to a wooden panel). This embodiment is particularly effective

in such a case where the positioning accuracy in forming the button hole in the wooden panel and the like is low. In the same manner, also with respect to the metal panel or the resin panel, this embodiment is particularly effective when it is difficult to ensure the sufficient positioning accuracy of the button hole.

In the abovementioned embodiment, the positioning means is constituted of the engaging projections 3b, 3c (engaging portions) which are formed on the outer button 3 and the engaging holes 1a, 1b (portions to be engaged) formed in the face panel 1. However, as another method, the engaging holes may be formed in the outer button 3 and the engaging projections may be formed on the face panel 1. Further, although the pair of engaging projections 3b, 3c are formed on both sides of the outer button 3 in this embodiment, the engaging projection may be formed on only one side of the outer button 3. Further, although the manipulation surface 3a of the outer button 3 is inclined with respect to the chassis 5 in this embodiment, the present invention is applicable to the outer button having the manipulation surface which is not inclined. Further, the illumination portion 3f is formed on the manipulation surface 3a of the outer button 3 in this embodiment, the present invention is applicable to the outer button having no illumination portion. Still further, in this embodiment, as the engaging means for mounting the inner button 4 on the chassis 5, the engaging holes 4g, 4h are formed in the inner button 4 and the engaging pawls 5b, 5c are formed on the chassis 5. However, as another method, the engaging pawls may be formed

on the inner button 4 and the engaging holes may be formed on the chassis 5.

As has been explained heretofore, according to the electronic equipment of the present invention, even when the positioning accuracy of the button hole formed in the panel is poor, it is possible to make the manipulation surface of the outer button accurately project through the button hole and, at the same time, it is possible to prevent the play of the outer button using the positioning means.

Although the invention has been explained in conjunction with the preferred embodiment shown in the drawings, it is evident that the various other embodiments and modifications can be made without departing from the concept of the present invention. The present invention includes other embodiments and modifications.